AMENDMENTS TO THE CLAIMS

1. (currently amended) An ethylene (co) polymer (A1) being either an ethylene homopolymer or a copolymer of ethylene and an α-olefin of 4 to 20 carbon atoms, wherein

(i_{A1}) the ethylene (co)polymer contains methyl branches less than 0.1 in number per 1,000 carbon atoms measured by ^{13}C-NMR, and

(ii_{A1}) the ethylene (co)polymer has a ratio of Mw/Mn (Mw denotes the weight average molecular weight; Mn denotes the number average molecular weight) measured by gel permeation chromatography is not lower than 1.8 and lower than 4.5 wherein

(iii_{A1}) the intrinsic viscosity measured at 135°C in decalin is within a range of 0.2 to 18 dl/g, and

(iv_{A1}) the number of branches having a length equivalent to that of hexyl or longer measured by ^{13}C-NMR is less than 0.1 per 1,000 of carbon atoms,

(v_{A1}) the intrinsic viscosity [η] in dl/g measured at 135°C in decalin and the melt flow rate MFR in g/10 minutes measured under 2.16 kg load at 190°C satisfy the following relations:

$[\eta] > 1.85 \times MFR^{-0.192}$ when $MFR < 1$, and

$[\eta] > 1.85 \times MFR^{-0.213}$ when $MFR \geq 1$.

2. (canceled).

3. (currently amended) The ethylene (co)polymer (A1) according to claim 1, wherein

~~(v_{A1})~~ (vi_{A1}) the intrinsic viscosity [η] in dl/g and the density d in g/cm^3 satisfy the following relation:

$d \geq 0.0003 \times [\eta]^2 - 0.0121 \times [\eta] + 0.9874$; in the case the intrinsic viscosity measured at 135°C in decalin is 0.3 to 1.5 dl/g.

4. (canceled)

5. (previously presented) The ethylene (co)polymer (A1) according to claim 1, wherein

(vii_{A1}) when the comonomer content is 1.5 mole% or higher, an amount of components eluted at 105°C or higher in a heating elution separation test is not more than 5% by weight; and when the comonomer content is less than 1.5 mole%, an amount of components eluted at 106°C or higher in a heating elution separation test is not more than 8% by weight.

6. (previously presented) The ethylene (co)polymer (A1) according to claim 1, wherein

($viii_{A1}$) the components are precipitated at 15% by weight or lower when said ethylene (co)polymer is dissolved in p-xylene at 130°C, then cooled to 75°C, and finally the dissolved components are precipitated in a poor solvent.

7. (previously presented) The ethylene (co)polymer (A1) according to claim 1, wherein

(ix_{A1}) the % by weight W of the decane-soluble components at 23°C and the density d in g/cm^3 satisfy the following relations:

$W < 80 \times \exp(-100 \times (d - 0.88)) + 0.1$ when MFR $\leq$ 10 g/10 minutes; and

$W < 80 \times (MFR - 9)^{0.26} \times \exp(-100 \times (d - 0.88)) + 0.1$ when MFR > 10 g/10 minutes.

8. (previously presented) The ethylene (co)polymer (A1) according to claim 1, wherein

(x_{A1}) the α-olefin content K in mole% and the melting point Tm in °C of the highest peak of an endothermic curve measured by a differential scanning calorimeter satisfy the following relations:

$Tm \leq 135.0 - 10.0K$ in the case K = 0.1 to 1.5 mole%;

$Tm \leq 121.9 - 1.3K$ in the case K = 1.5 to 5.5 mole%; and

$Tm \leq 139.7 - 4.5K$ in the case K = 5.5 to 20 mole%.

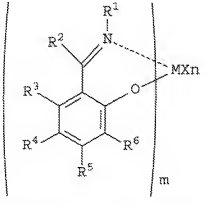
9. (canceled)

10. (previously presented) The ethylene (co)polymer (A1) according to claim 1, wherein the ethylene (co)polymer is a copolymer of ethylene and 1-butene.

11. (previously presented) The ethylene (co)polymer (A1) according to claim 1, wherein the ethylene (co)polymer is a copolymer of ethylene and 1-hexene.

12. (previously presented) The ethylene (co)polymer (A1) according to claim 1 or 3, said ethylene (co)polymer (A1) is produced by either homopolymerization of ethylene or copolymerization of ethylene and an α-olefin of 4 to 20 carbon atoms in the presence of an olefin polymerization catalyst comprising:

(a1) a transition metal compound of the following general formula (I)



(I)

wherein M denotes a transition metal atom selected from the group consisting of group IV and group V of the periodic table;

m denotes 1 or 2;

R^1 denotes an aliphatic hydrocarbon group of 5 or more carbon atoms in total which may have alicyclic hydrocarbon group substituents or alicyclic hydrocarbon group of 7 or more carbon atoms in total which may have aromatic hydrocarbon group or aliphatic hydrocarbon group substituents;

R^2 to R^5 may be the same or different to one another and each denotes a hydrogen atom, a hydrocarbon group, a hydrocarbon group-substituted silyl, an oxygen-containing group, a nitrogen-containing group, or a sulfur-containing group and two or more of R^2 to R^5 may be bonded to one another to form a ring;

R^6 denotes a hydrocarbon group or a hydrocarbon-substituted silyl group;

in the case m is 2, at least one of the groups denoted as R^2 to R^6 belonging to any one of the ligands may be bonded to at least one of the groups denoted as R^2 to R^6 belonging to another ligand;

in the case m is 2, two of R^1, two of R^2, two of R^3, two of R^4, two of R^5, and two of R^6 may be the same or different to one another, and at least one of the groups R^2 to R^6 on ligand may be bonded to at least one of the groups R^2 to R^6 on another ligand;

n denotes a number satisfying the valence of M;

X denotes a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue group, a silicon-containing group, a germanium-containing group, or a tin-containing group; in the case n is 2 or higher, X may be the same or different to one another and X may be bonded to one another to form a ring; and

(b) at least one compound selected from the group consisting of:

(b-1) an organometallic compound,

(b-2) an organoaluminum oxy compound, and

(b-3) a compound capable of forming ion pairs by reaction on the transition metal compound.

13. (previously presented) An ethylene (co)polymer (A2) being either an ethylene homopolymer or a copolymer of ethylene and an α-olefin of 4 to 20 carbon atoms, wherein

(i_{A2}) the ethylene (co)polymer contains methyl branches less than 0.1 in number per 1,000 carbon atoms measured by ^{13}C-NMR, and

(ii_{A2}) the ethylene (co)polymer has Mw/Mn (Mw denotes the weight average molecular weight; Mn denotes the number average molecular weight) measured by gel permeation chromatography of 5.5 to 50, and wherein

(x_{A2}) the decane-soluble components (W (% by weight)) at 23°C and the density (d (g/cm^3)) satisfy the following relations;

$W < 80 \times \exp(-100 \times (d - 0.88)) + 0.1$ in the case $MFR \leq 10$ g/10 minutes and

$W < 80 \times (MFR - 9)^{0.26} \times \exp(-100 \times (d - 0.88)) + 0.1$ in the case $MFR > 10$ g/10 minutes.

14. (original) The ethylene (co)polymer (A2) according to claim 13, wherein

(iii_{A2}) the intrinsic viscosity measured at 135°C in decalin is within a range of 0.2 to 18 dl/g.

15. (previously presented) The ethylene (co)polymer (A2) according to claims 13 or 14, wherein

(iv_{A2}) the intrinsic viscosity ([η] (dl/g)) measured in 135°C decalin and the melt flow rate (MFR (g/10 minutes)) measured under 2.16 kg load at 190°C satisfy the following relations;

$[\eta] > 1.85 \times MFR^{-0.192}$ in the case of $MFR < 1$ and

$[\eta] > 1.85 \times MFR^{-0.213}$ in the case of $MFR \geq 1$.

16. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14, wherein

(v_{A2}) the components having a molecular weight of 500,000 reduced to polyethylene measured by GPC-IR are not more than 5% by weight in the components eluted at 105°C or higher in a heating elution separation test.

17. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14, wherein

(vi_{A2}) the components eluted at 105°C or higher in a heating elution separation test are not more than 5% by weight in the case the comonomer content is 1.5 mole% or higher and the components eluted at 106°C or higher in a heating elution separation test are not more than 8% by weight in the case the comonomer content is less than 1.5 mole%.

18. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14, wherein

(vii_{A2}) the components having a molecular weight of 10,000 or more reduced to polyethylene measured by GPC-IR among components obtained by dissolution of the ethylene (co)polymer in p-xylene at 130°C and successive precipitation of the dissolved components by cooling to 75°C in a poor solvent are not more than 30% by weight in the precipitated components.

19. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14, wherein

($viii_{A2}$) the components obtained by dissolution of the ethylene (co)polymer in p-xylene at 130°C and successive precipitation of the dissolved components by cooling to 75°C in a poor solvent are not more than 15% in whole ethylene (co)polymer.

20. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14, wherein

(ix_{A2}) the components having a molecular weight of 10,000 or more reduced to polyethylene measured by GPC-IR among components precipitated by dissolution of the ethylene (co)polymer in p-xylene at 130°C and successive precipitation of the dissolved components by cooling to 75°C in a poor solvent are not more than 5% in whole ethylene (co)polymer.

21. (canceled)

22. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14, wherein

(xi_{A2}) the number of branches having a length equivalent to that of hexyl or longer measured by ^{13}C-NMR is less than 0.1 per 1,000 of carbon atoms.

23. (canceled).

24. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14, wherein

($xiii_{A2}$) components to be eluted at 109°C or higher in a heating elution separation test exist and the intrinsic viscosity ([η] (dl/g)) thereof measured at 135°C in decalin and the density (d (g/cm^3)) of said components satisfy the following relation;

$d \geq 0.0003 \times [\eta]^2 - 0.0121 \times [\eta] + 0.9874$.

25. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14 wherein the ethylene (co)polymer is a copolymer of ethylene and 1-butene.

26. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14 wherein the ethylene (co)polymer is a copolymer of ethylene and 1-hexene.

27. (previously presented) The ethylene (co)polymer (A2) according to claim 13 or 14, comprising

(A2-1) either ethylene homopolymer or a copolymer of ethylene and an α-olefin of 4 to 20 carbon atoms, having

(i_{A2-1}) the intrinsic viscosity($[\eta]_{A2-1}$) measured at 135°C in decalin is within a range of 0.3 to 2.5 dl/g,

(ii_{A2-1}) the number of methyl branches measured by ^{13}C-NMR is less than 0.1 per 1,000 of carbon atoms, and

(iii_{A2-1}) Mw/Mn (Mw denotes the weight average molecular weight; Mn denotes the number average molecular weight) measured by gel permeation chromatography within a range of 3 to 8, and

(A2-2) either ethylene homopolymer or a copolymer of ethylene and an α-olefin of 4 to 20 carbon atoms, having

(i_{A2-2}) the intrinsic viscosity ($[\eta]_{A2-2}$) measured at 135°C in decalin within a range of 2.0 to 20 dl/g, and

(ii_{A2-2}) the number of methyl branches measured by ^{13}C-NMR less than 0.1 per 1,000 of carbon atoms;

wherein a relation between the intrinsic viscosity ($[\eta]_{A2-1}$) of said ethylene (co)polymer (A2-1) and the intrinsic viscosity ($[\eta]_{A2-2}$) of said ethylene (co)polymer (A2-2) satisfy $[\eta]_{A2-1} \leq [\eta]_{A2-2}$ and the ethylene (co)polymer contains 10 to 90 parts by weight of said ethylene (co)polymer (A2-1) and 10 to 90 parts by weight of said ethylene (co)polymer (A2-2), where (A2-1) + (A2-2) = 100 parts by weight.

28. (original) The ethylene (co)polymer (A2) according to claim 27, wherein said ethylene (co)polymer (A2-1) satisfies the following relation between the intrinsic viscosity ($[\eta]$ (dl/g)) and the density (d (g/cm^3));

$d \geq 0.0003 \times [\eta]^2 - 0.0121 \times [\eta] + 0.9874$; in the case the intrinsic viscosity measured at 135°C in decalin is 0.3 to 1.5 dl/g.

29. (canceled)

30. (previously presented) An ethylene (co)polymer (A3) which is either an ethylene homopolymer or a copolymer of ethylene and an α-olefin of 3 to 20 carbon atoms, wherein

(i_{A3}) the melt tension (MT (g)) at 190°C and the swell ratio (SR) calculated from the strand diameter extruded at 190°C satisfy the relation;

$\log(MT) > 12.9 - 7.15 \times SR$; and

(ii_{A3}) the intrinsic viscosity ($[\eta]$ (dl/g)) measured at 135°C in decalin and the melt flow rate (MFR (g/10 minutes)) measured under 2.16 kg load at 190°C satisfy the relations;

$[\eta] > 1.85 \times MFR^{-0.192}$ in the case of MFR < 1 and

$[\eta] > 1.85 \times MFR^{-0.213}$ in the case of MFR ≥ 1,

wherein

(iii_{A3}) the weight average molecular weight (Mw) measured by gel permeation chromatography and the swell ratio (SR) calculated from the strand diameter extruded at 190°C satisfy the relation;

$SR > 4.55 - 0.56 \times \log(Mw)$.

31. (previously presented) The ethylene (co)polymer (A3) according to claim 30, wherein

(iv_{A3}) the number average molecular weight (Mn), the weight average molecular weight (Mw), and the Z average molecular weight (Mz) measured by gel permeation chromatography satisfy the relations;

$Mz/Mw \geq 7/(1 - 5.5/(Mw/Mn))$, and

$Mw/Mn > 5.5$.

32. (previously presented) The ethylene (co)polymer (A3) according to claim 30, wherein

(v_{A3}) the number of the vinyl groups at the molecular terminals calculated by conversion to that per one molecular chain having the same molecular weight as the number average molecular weight is not lower than 0.50.

33. (previously presented) The ethylene (co)polymer (A3) according to claim 30, wherein the ethylene (co)polymer is an ethylene homopolymer or a copolymer of ethylene and an α-olefin of 4 to 20 carbon atoms and has methyl branches measured by ^{13}C-NMR less than 0.1 in number per 1,000 of carbon atoms.

34. (previously presented) An ethylene (co)polymer (A4) being an ethylene homopolymer or a copolymer of ethylene and an α-olefin of 3 to 20 carbon atoms, wherein

(i_{A4}) the number average molecular weight (Mn), the weight average molecular weight (Mw), and the Z average molecular weight (Mz) measured by gel permeation chromatography satisfy the relation;

$Mz/Mw \geq 4/(0.5 - 4.50/((Mw/Mn) - 0.2))$, and

$Mw/Mn > 9.2$.

35. (original) The ethylene (co)polymer (A4) according to claim 34, wherein

(iii_{A4}) the melt tension (MT (g)) at 190°C and the swell ratio (SR) calculated from the strand diameter extruded at 190°C satisfy the relation;

$\log(MT) > 12.9 - 7.15 \times SR$; and

(iv_{A4}) the intrinsic viscosity ([η] (dl/g)) measured at 135°C in decalin and the melt flow rate (MFR (g/10 minutes)) measured under 2.16 kg load at 190°C satisfy the relations;

$[\eta] > 1.85 \times MFR^{-0.192}$ in the case of $MFR < 1$, and

$[\eta] > 1.85 - MFR^{-0.213}$ in the case of $MFR \geq 1$.

36. (original) The ethylene (co)polymer (A4) according to claim 34,
wherein

(ii_{A4}) the weight average molecular weight (Mw) measured by gel permeation chromatography and the swell ratio (SR) calculated from the strand diameter extruded at 190°C satisfy the relation;

$SR > 4.55 - 0.56 \times \log(Mw)$;

(iii_{A4}) the melt tension (MT (g)) at 190°C and the swell ratio (SR) calculated from the strand diameter extruded at 190°C satisfy the relation;

$\log (MT) > 12.9 - 7.15 \times SR$; and

(iv_{A4}) the intrinsic viscosity ([η] (dl/g)) measured at 135°C in decalin and the melt flow rate (MFR (g/10 minutes)) measured under 2.16 kg load at 190°C satisfy the relations;

$[\eta] > 1.85 \times MFR^{-0.192}$ in the case of $MFR < 1$, and

$[\eta] > 1.85 \times MFR^{-0.213}$ in the case of $MFR \geq 1$.

37. (previously presented) The ethylene (co)polymer (A4) according to any one of the claims 34 to 36, wherein

(v_{A4}) the number of the vinyl groups at the molecular terminals calculated by conversion to that per one molecular chain having the same molecular weight as the number average molecular weight is not lower than 0.50.

38. (previously presented) The ethylene (co)polymer (A4) according to any one of the claims 34 to 36, wherein the ethylene (co)polymer is either an ethylene homopolymer or a (co)polymer of ethylene and an α-olefin of 4 to 20 carbon atoms and has methyl branches measured by ^{13}C-NMR less than 0.1 in number per 1,000 of carbon atoms.

39. (original) An ethylene (co)polymer (A5) being either an ethylene homopolymer or a copolymer of ethylene and an α-olefin of 3 to 20 carbon atoms, wherein

(i_{A5}) there are at least 2 maximum values and at least 1 minimum value in the molecular weight distribution curve measured by gel permeation chromatography and the intensity (W_1) of the minimum value and the lower intensity (W_2) of the maximum values having the minimum value between them satisfy;

$W_1/W_2 < 0.85$.

40. (original) The ethylene (co)polymer (A5) according to claim 39, wherein

(iii_{A5}) the melt tension (MT (g)) at 190°C and the swell ratio (SR) calculated from the strand diameter extruded at 190°C satisfy the relation;

$\log(MT) > 12.9 - 7.15 \times SR$; and

(vi_{A5}) the intrinsic viscosity ([η] (dl/g)) measured at 135°C in decalin and the melt flow rate (MFR (g/10 minutes)) measured under 2.16 kg load at 190°C satisfy the relations;

$[\eta] > 1.85 \times MFR^{-0.192}$ in the case of $MFR < 1$, and

$[\eta] > 1.85 \times MFR^{-0.213}$ in the case of $MFR \geq 1$.

41. (original) The ethylene (co)polymer (A5) according to claim 39, wherein

(ii_{A5}) the weight average molecular weight (Mw) measured by gel permeation chromatography and the swell ratio (SR) calculated from the strand diameter extruded at 190°C satisfy the relation;

$SR > 4.55 - 0.56 \times \log(Mw)$;

(iii$_{A5}$) the melt tension (MT (g)) at 190°C and the swell ratio (SR) calculated from the strand diameter extruded at 190°C satisfy the following relation;

$\log(MT) > 12.9 - 7.15 \times SR$; and

(vi$_{A5}$) the intrinsic viscosity ([η] (dl/g)) measured at 135°C in decalin and the melt flow rate (MFR (g/10 minutes)) measured under 2.16 kg load at 190°C satisfy the relations;

$[\eta] > 1.85 \times MFR^{-0.192}$ in the case of MFR < 1, and

$[\eta] > 1.85 \times MFR^{-0.213}$ in the case of MFR ≥ 1.

42. (original) The ethylene (co)polymer (A5) according to any one of the claims 39 to 41, wherein

(v_{A5}) the number of the vinyl groups at the molecular terminals calculated by conversion to that per one molecular chain having the same molecular weight as the number average molecular weight is not lower than 0.50.

43. (previously presented) The ethylene (co)polymer (A5) according to any one of the claims 39 to 41, wherein the ethylene (co)polymer is either an ethylene homopolymer or a (co)polymer of ethylene and an α-olefin of 4 to 20 carbon atoms and contains methyl branches measured by ^{13}C-NMR less than 0.1 in number per 1,000 of carbon atoms.

44-77. (canceled)